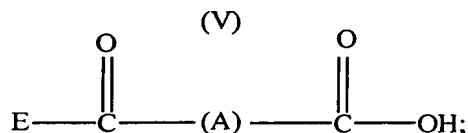
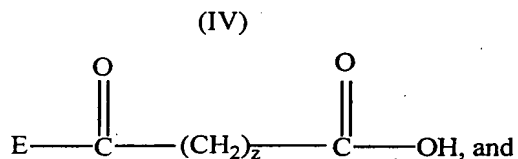
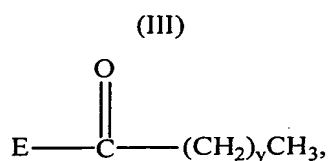
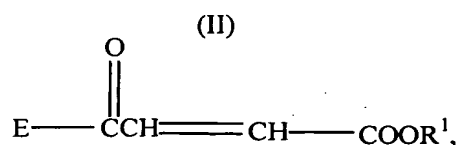
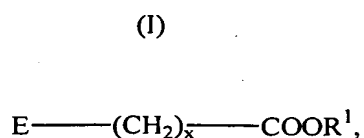


CLAIMS

We claim:

1. A nanocomposite comprising clay and an elastomer comprising C₂ to C₁₀ olefin derived units; wherein the elastomer also comprises functionalized monomer units described by the following groups (I), (II), (III), (IV) and (V) pendant to the elastomer, E:



- wherein R¹ is selected from hydrogen, C₁ to C₂₀ alkyls, alkenyls or aryls, substituted C₁ to C₂₀ alkyls, alkenyls or aryls; wherein the value of x ranges from 0 to 20, preferably from 1 to 10, and more preferably from 1 to 5; and wherein the value of y ranged from 0 to 20, preferably from 0 to 10; and wherein the value of z ranges from 1 to 20, preferably from 1 to 10, and more preferably from 1 to 5; and wherein "A" is an aryl group, either substituted or not.

2. The nanocomposite of Claim 1, wherein the elastomer also comprises monomer units selected from styrenic derived units and substituted styrenic derived units.

3. The nanocomposite of Claim 2, wherein the styrenic units are functionalized.
4. The nanocomposite of Claim 1, wherein the elastomer is not halogenated.
5. The nanocomposite of Claim 1, wherein the olefin is selected from one or more of isobutylene, isobutene, isoprene, cyclopentadiene, 2-methyl-1-butene, 3-methyl-1-butene, 2-methyl-2-butene, and 4-methyl-1-pentene, ethylene, propene, 1-butene, 1-hexene, and 1-octene.
- 10 6. The nanocomposite of Claim 2, wherein the styrene derived units are present from 1 to 15 wt% of the elastomer.
- 15 7. The nanocomposite of Claim 1, wherein the elastomer comprises *p*-methylstyrene derived units.
8. The nanocomposite of Claim 1, wherein the elastomer also comprises isoolefin derived units and *p*-methylstyrene derived units.
- 20 9. The nanocomposite of Claim 1, wherein the elastomer also comprises multiolefin derived units.
10. The nanocomposite of Claim 1, wherein the elastomer is selected from any one or a mixture of natural rubber, poly(isobutylene-*co*-isoprene),
25 polybutadiene, poly(styrene-*co*-butadiene) rubber, poly(isoprene-*co*-butadiene), poly(styrene-isoprene-butadiene), star-branched polyisobutylene rubber, poly(isobutylene-*co*-*p*-methylstyrene), ethylene-propylene-alkylstyrene rubber, ethylene-propylene-styrene rubber.
- 30 11. The nanocomposite of Claim 1, wherein the functionalized units are present on the elastomer from 0.01 wt% to 15 wt% of the elastomer.

12. The nanocomposite of Claim 1, wherein the clay has been treated with an exfoliating agent to form an exfoliated clay.
- 5 13. The nanocomposite of Claim 12, wherein the exfoliating agent is selected from ammonium ion, alkylamines, alkylammonium ion (primary, secondary, tertiary and quaternary), phosphonium or sulfonium derivatives of aliphatic, aromatic or arylaliphatic amines, phosphines and sulfides and blends thereof.
- 10 14. The nanocomposite of Claim 1, wherein the clay is present from 0.1 wt% to 50 wt% of the nanocomposite.
- 15 15. The nanocomposite of Claim 1, wherein the clay is present from 0.5 wt% to 15 wt% of the nanocomposite.
16. The nanocomposite of Claim 1, also comprising a filler selected from carbon black, modified carbon black, silica, precipitated silica, and blends thereof.
- 20 17. The nanocomposite of Claim 1, also comprising one or more curing agents.
- 25 18. The nanocomposite of Claim 17, wherein the curing agent is selected from zinc, zinc stearate, fatty acids, sulfur, diamine, diepoxy, polyamine, polyepoxy and mixtures thereof.
- 30 19. The nanocomposite of Claim 1, also comprising a secondary rubber selected from natural rubber, polybutadiene rubber, nitrile rubber, silicon rubber, polyisoprene rubber, poly(styrene-co-butadiene) rubber, poly(isoprene-co-butadiene) rubber, styrene-isoprene-butadiene rubber, ethylene-propylene rubber, brominated butyl rubber, chlorinated butyl rubber, halogenated isoprene, halogenated isobutylene copolymers,

polychloroprene, star-branched polyisobutylene rubber, star-branched brominated butyl rubber, poly(isobutylene-co-isoprene) rubber; halogenated poly(isobutylene-co-*p*-methylstyrene), ethylene-propylene rubber and mixtures thereof.

5

20. A tire innerliner comprising the nanocomposite of Claim 1.

21. An innertube comprising the nanocomposite of Claim 1.

10 22. A method of forming a nanocomposite comprising contacting clay, an elastomer, an grafting promoter, and at least one functionalizing compound, wherein the elastomer comprises C₂ to C₁₀ olefin derived units.

15 23. The method of Claim 22, wherein the elastomer is first contacted with the functionalizing compound, followed by contacting with the clay.

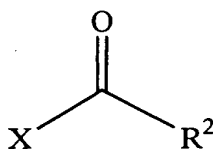
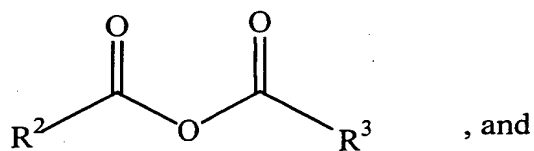
24. The method of Claim 22, wherein the elastomer, clay and acid functionalizing compound are contacted simultaneously.

20 25. The method of Claim 22, wherein the grafting promoter is a Lewis acid selected from halide and alkyl containing compounds of boron, aluminum, gallium, indium, titanium, zirconium, tin, arsenic, antimony and bismuth, and mixtures thereof.

25 26. The method of Claim 22, further comprising contacting a diluent selected from carbon disulfide, nitrobenzene, methylene chloride, 1,2 dichloroethane, hexane, cyclohexane and mixtures thereof.

30 27. The method of Claim 22, wherein the elastomer and functionalizing compound are melt blended.

28. The method of Claim 22, wherein the functionalizing compound is selected from CO₂ and the following:



5 wherein R² and R³ are the same or different and are selected from hydrogen, C₁ to C₁₀ alkyls, alkenyls and aryls, hydroxyl, and C₁ to C₁₀ alkoxys, wherein R² and R³ may form a ring structure; and wherein X is selected from hydroxyl, halides, preferably bromine and chlorine, and alkoxy groups.

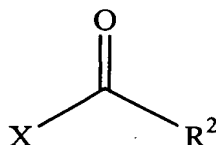
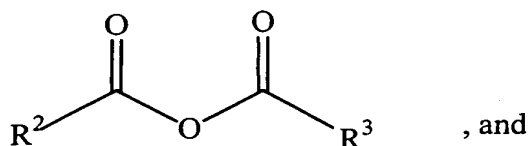
10 29. The method of Claim 22, wherein the functionalizing compound is selected from succinic anhydride, maleic anhydride, phthalic anhydride, glutaric anhydride, citraconic anhydride, itaconic anhydride, and other cyclic anhydrides, succinyl chloride, glutaryl chloride, itaconyl chloride, malonyl chloride, adipoyl chloride, diethylmalonyl dichloride, 3-methyladipoyl chloride, pimeloyl chloride, suberoyl chloride, azelaoyl
15 chloride, sebacoyl chloride, isophthaloyl dichloride, phthaloyldichloride, terephthaoyl chloride.

20 30. The method of Claim 22, wherein the elastomer also comprises monomer units selected from styrenic derived units and substituted styrenic derived units.

31. The method of Claim 22, wherein the olefin is selected from one or more of isobutylene, isobutene, isoprene, cyclopentadiene, 2-methyl-1-butene, 3-methyl-1-butene, 2-methyl-2-butene, and 4-methyl-1-pentene, ethylene, propene, 1-butene, 1-hexene, and 1-octene.
- 5 32. The method of Claim 30, wherein the styrene derived units are present from 1 to 15 wt% of the elastomer.
- 10 33. The method of Claim 22, wherein the elastomer comprises *p*-methylstyrene derived units.
34. The method of Claim 22, wherein the elastomer also comprises isoolefin derived units and *p*-methylstyrene derived units.
- 15 35. The method of Claim 22, wherein the elastomer also comprises multiolefin derived units.
- 20 36. The method of Claim 22, wherein the elastomer is selected from any one or a mixture of natural rubber, poly(isobutylene-*co*-isoprene), polybutadiene, poly(styrene-*co*-butadiene) rubber, poly(isoprene-*co*-butadiene), poly(styrene-isoprene-butadiene), star-branched polyisobutylene rubber, poly(isobutylene-*co-p*-methylstyrene), ethylene-propylene-alkylstyrene rubber, ethylene-propylene-styrene rubber.
- 25 37. The method of Claim 22, wherein the elastomer is functionalized by contacting with the functionalizing compound, wherein the functional groups are present on the elastomer from 0.01 wt% to 15 wt% of the elastomer.
- 30 38. The method of Claim 22, wherein the clay has been treated with an exfoliating agent to form an exfoliated clay.

39. The method of Claim 38, wherein the exfoliating agent is selected from ammonium ion, alkylamines, alkylammonium ion (primary, secondary, tertiary and quaternary), phosphonium or sulfonium derivatives of aliphatic, aromatic or arylaliphatic amines, phosphines and sulfides and blends thereof.
40. The method of Claim 22, wherein the clay is present from 0.1 wt% to 50 wt% of the nanocomposite.
41. The method of Claim 22, wherein the clay is present from 0.5 wt% to 15 wt% of the nanocomposite.
42. The method of Claim 22, also comprising a filler selected from carbon black, modified carbon black, silica, precipitated silica, and blends thereof.
43. The method of Claim 22, also comprising one or more curing agents.
44. The method of Claim 43, wherein the curing agent is selected from zinc, zinc stearate, fatty acids, sulfur, diamine, diepoxy, polyamine, polyepoxy and mixtures thereof.
45. The method of Claim 22, also comprising a secondary rubber selected from natural rubber, polybutadiene rubber, nitrile rubber, silicon rubber, polyisoprene rubber, poly(styrene-*co*-butadiene) rubber, poly(isoprene-*co*-butadiene) rubber, styrene-isoprene-butadiene rubber, ethylene-propylene rubber, brominated butyl rubber, chlorinated butyl rubber, halogenated isoprene, halogenated isobutylene copolymers, polychloroprene, star-branched polyisobutylene rubber, star-branched brominated butyl rubber, poly(isobutylene-*co*-isoprene) rubber; halogenated poly(isobutylene-*co*-*p*-methylstyrene), ethylene-propylene rubber and mixtures thereof.
46. A tire innerliner made by the method of Claim 22.

47. An innertube made by the method of Claim 22.
48. A nanocomposite comprising clay and the reaction product of contacting an elastomer comprising C₂ to C₁₀ olefin derived units, an grafting promoter, and at least one functionalizing compound.
49. The nanocomposite of Claim 48, wherein the functionalizing compound is selected from CO₂ and the following:



wherein R² and R³ are the same or different and are selected from hydrogen, C₁ to C₁₀ alkyls, alkenyls and aryls, hydroxyl, and C₁ to C₁₀ alkoxys, wherein R² and R³ may form a ring structure; and wherein X is selected from hydroxyl, halides, preferably bromine and chlorine, and alkoxy groups.

50. The nanocomposite of Claim 48, wherein the functionalizing compound is selected from succinic anhydride, maleic anhydride, phthalic anhydride, glutaric anhydride, itaconic anhydride, and other cyclic anhydrides, succinyl chloride, glutaryl chloride, itaconyl chloride, malonyl chloride, adipoyl chloride, diethylmalonyl dichloride, 3-methyladipoyl chloride, pimeloyl chloride, suberoyl chloride, azelaoyl

chloride, sebacoyl chloride, isophthaloyl dichloride, phthaloyldichloride, terephthaoyl chloride.

51. The nanocomposite of Claim 48, wherein the grafting promoter is a Lewis
5 acid selected from halide and alkyl containing compounds of boron, aluminum, gallium, indium, titanium, zirconium, tin, arsenic, antimony and bismuth, and mixtures thereof.
52. The nanocomposite of Claim 48, wherein the components are contacted in
10 a diluent selected from carbon disulfide, nitrobenzene, methylene chloride, 1,2 dichloroethane, hexane, cyclohexane and mixtures thereof.
53. The nanocomposite of Claim 48, wherein the elastomer also comprises
15 monomer units selected from styrenic derived units and substituted styrenic derived units.
54. The nanocomposite of Claim 53, wherein the styrenic units are functionalized.
- 20 55. The nanocomposite of Claim 48, wherein the elastomer is not halogenated.
56. The nanocomposite of Claim 48, wherein the olefin is selected from one or
more of isobutylene, isobutene, 2-methyl-1-butene, 3-methyl-1-butene, 2-
25 methyl-2-butene, and 4-methyl-1-pentene, ethylene, propene, 1-butene, 1-hexene, and 1-octene.
57. The nanocomposite of Claim 53, wherein the styrene derived units are present from 1 to 15 wt% of the elastomer.
- 30 58. The nanocomposite of Claim 48, wherein the elastomer comprises *p*-methylstyrene derived units.

59. The nanocomposite of Claim 48, wherein the elastomer also comprises isoolefin derived units and *p*-methylstyrene derived units.
- 5 60. The nanocomposite of Claim 48, wherein the elastomer also comprises multiolefin derived units.
61. The nanocomposite of Claim 48, wherein the elastomer is selected from any one or a mixture of natural rubber, poly(isobutylene-*co*-isoprene), polybutadiene, poly(styrene-*co*-butadiene) rubber, poly(isoprene-*co*-butadiene), poly(styrene-isoprene-butadiene), star-branched
10 polyisobutylene rubber, poly(isobutylene-*co*-*p*-methylstyrene), ethylene-propylene-alkylstyrene rubber, ethylene-propylene-styrene rubber.
62. The nanocomposite of Claim 48, wherein the functionalized derived units
15 are present on the elastomer from 0.01 wt% to 15 wt% of the elastomer.
63. The nanocomposite of Claim 48, wherein the clay has been treated with an exfoliating agent to form an exfoliated clay.
- 20 64. The nanocomposite of Claim 63, wherein the exfoliating agent is selected from ammonium ion, alkylamines, alkylammonium ion (primary, secondary, tertiary and quaternary), phosphonium or sulfonium derivatives of aliphatic, aromatic or arylaliphatic amines, phosphines and sulfides and blends thereof.
- 25 65. The nanocomposite of Claim 48, wherein the clay is present from 0.1 wt% to 50 wt% of the nanocomposite.
- 30 66. The nanocomposite of Claim 48, wherein the clay is present from 0.5 wt% to 15 wt% of the nanocomposite.

67. The nanocomposite of Claim 48, also comprising a filler selected from carbon black, modified carbon black, silica, precipitated silica, and blends thereof.
- 5 68. The nanocomposite of Claim 48, also comprising one or more curing agents.
69. The nanocomposite of Claim 68, wherein the curing agent is selected from zinc, zinc stearate, fatty acids, sulfur, diamine, diepoxy, polyamine, polyepoxy and mixtures thereof.
- 10
70. The nanocomposite of Claim 48, also comprising a secondary rubber selected from natural rubber, polybutadiene rubber, nitrile rubber, silicon rubber, polyisoprene rubber, poly(styrene-*co*-butadiene) rubber, poly(isoprene-*co*-butadiene) rubber, styrene-isoprene-butadiene rubber, ethylene-propylene rubber, brominated butyl rubber, chlorinated butyl rubber, halogenated isoprene, halogenated isobutylene copolymers, polychloroprene, star-branched polyisobutylene rubber, star-branched brominated butyl rubber, poly(isobutylene-*co*-isoprene) rubber; halogenated poly(isobutylene-*co*-*p*-methylstyrene) and mixtures thereof.
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71. A tire innerliner comprising the nanocomposite of Claim 48.
72. An innertube comprising the nanocomposite of Claim 48.
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